

Aug. 6, 1940.

J. SACHS

2,210,262

AUTOMATIC CIRCUIT BREAKER

Filed Feb. 27, 1939

Fig. 1

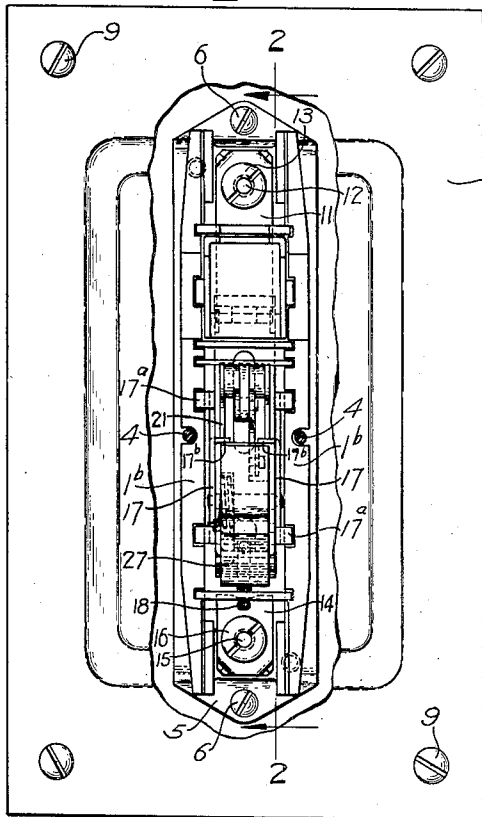


Fig. 2

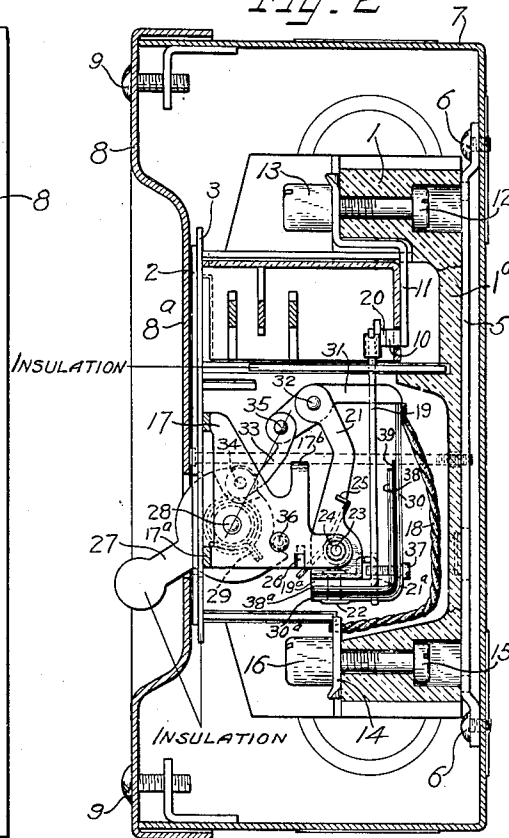


Fig. 3

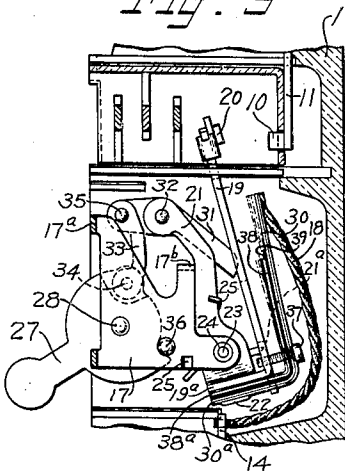
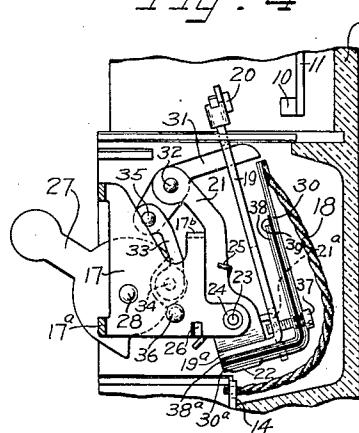


Fig. 4



Inventor
Joseph Sachs
By S. Jay Teller
Attorney

UNITED STATES PATENT OFFICE

2,210,262

AUTOMATIC CIRCUIT BREAKER

Joseph Sachs, West Hartford, Conn., assignor to
Colt's Patent Fire Arms Manufacturing Com-
pany, Hartford, Conn., a corporation of Con-
necticut

Application February 27, 1939, Serial No. 258,703

2 Claims. (Cl. 200—116)

This invention relates to automatic circuit breakers of the type wherein the electro-responsive means comprises a bi-metallic element adapted upon being heated and deflected to cause the automatic opening of the circuit. The invention is applicable to a circuit breaker of this type wherein the bi-metallic element is bodily movable with the movable contact as exemplified in my reissued Patent No. 20,018 entitled Automatic circuit breaker.

With any such automatic circuit breaker utilizing a bi-metallic strip as the sole electro-responsive means for effecting opening of the circuit, there is an appreciable delay in the opening by reason of the time required for heating and deflecting the strip. In some instances it is found desirable to provide for a delay in opening somewhat greater than that ordinarily obtained, and it is the general object of the present invention to provide for such increased delay.

In accordance with the invention I provide not only the usual current carrying bi-metallic strip but also a second strip which does not carry current, but which is closely adjacent the first strip so as to receive heat therefrom. This second strip upon being heated acts mechanically on the first strip to increase the deflection thereof, but this mechanical action of the second strip upon the first is necessarily delayed on account of the time required for the heating of the second strip.

In the accompanying drawing I have shown one suitable embodiment of the invention, and I have selected for illustration the mechanism shown in my co-pending application for Automatic circuit breakers, Serial No. 152,020 filed July 6, 1937. It will be understood however, that I do not limit myself to the mechanism shown and the drawing is intended for illustrative purposes only and is not to be construed as defining or limiting the scope of the invention, the claims forming a part of this specification being relied upon for that purpose.

Of the drawing:

Fig. 1 is a front view of a circuit breaker embodying the invention, with certain parts broken away to show other parts more clearly.

Fig. 2 is a vertical sectional view taken along the line 2—2 of Fig. 1.

Fig. 3 is a fragmentary vertical sectional view similar to Fig. 2, but showing the parts in the positions which they assume upon automatic opening while the handle is held in closed-circuit position.

Fig. 4 is a view similar to Fig. 3, but showing all

of the parts including the handle in open circuit positions.

A main base or housing 1 is provided which supports the circuit breaker mechanism and all of the conducting parts. As shown this is an integral structure comprising a rear wall 1^a and two forward projecting side walls 1^b, 1^b which are spaced apart and which are identical in construction. The housing has a front cover 2 which may be of metal, an insulating sheet 3 being interposed between the cover and the housing. The cover 2 and sheet 3 will be referred collectively as constituting the front cover plate. The front cover plate is held in place by screws 4, 4 which also serve to secure the housing 1 to a metallic supporting plate 5. The supporting plate 5 is secured by suitable means, such as screws 6, 6, to the rear wall of an outer metallic casing 7. The casing 7 has an openable front cover 8 secured by screws 9, 9, the said cover preferably having a central depressed portion 8^a closely adjacent the housing cover 2.

A stationary main contact 10 is provided which is carried by a resilient conductor 11 located near the upper end of the base or housing 1 and held in place by a screw 12. A nut 13 on the screw 12 cooperates with the conductor 11 to form a wire terminal. A stationary conductor 14 is secured to the base or housing 1 near the lower end thereof by means of a screw 15. A nut 16 on the screw 15 cooperates with the conductor 14 to constitute a wire terminal.

A mechanism supporting frame is positioned between the main side walls 1^b, 1^b of the housing, this frame comprising two similar plates 17, 17. The frame is so engaged by the housing that rearward movement thereof is prevented, and for this purpose the plates 17, 17 have lateral projections 17^a, 17^a which are seated in notches in the side walls of the housing and which prevent rearward movement of the frame. Forward movement of the frame is prevented by the front cover plate when the said plate is in place.

Directly connected electrically with the stationary conductor 14 is a flexible conductor 18. For making and breaking the circuit between the contact 10 and the conductors 14 and 18 there is provided a contact carrying member which is movable about a fixed axis. The said contact member comprises a conducting element or bar 19 which carries a movable contact 20 adapted to engage and disengage the stationary contact 10. The contact member also comprises an arm 21 which is in generally parallel relationship with

the bar 19 and which is formed of sheet metal bent to a U-shape to provide two similar legs. The conducting bar 19 has an angularly bent portion 19^a which directly engages the transverse portion of the operating arm between the two legs thereof, the last said portions being held together by a rivet 22.

The contact member is pivotally mounted between the plates 17, 17 of the frame, by means of a transverse bearing member 23. The bearing member 23 is supported in insulating bushings 24 which insulate the contact member from the supporting frame. Surrounding the member 23 is a coil spring 25 which engages the arm 21 and also engages an insulating member 26 extending transversely between the frame side plates, this spring thus serving to bias the contact member in the contact disengaging direction. Projections 17^b, 17^b on the frame plates serve to engage the legs of the arm 21 and thus limit forward movement of the contact member.

A handle or operating member 27 is pivotally supported on the supporting frame by means of a pivot pin 28 extending transversely between the frame side plates. The forward or handle portion of the operating member projects through suitable openings in the front cover plate of the housing and in the front cover 8 of the outer casing. The operating member 27 is biased in the clockwise direction by a spring 29.

In order that the operating member 27 may operate the contact member, there is provided a connecting mechanism which is controlled by means of a bi-metallic element 30 bodily movable with the contact member and serving in and of itself as a latch which cooperates directly with an actuator 31 mechanically connected with the operating member.

The actuator 31 is carried directly upon the arm 21 of the contact member so as to move bodily therewith, and it is pivotally mounted at 32 between the two legs of the said arm. The actuator 31 is insulated from the arm 21 by means of suitable insulating bushings (not shown) which surround the pivot pin 32. The actuator 31 extends rearward and projects through a slot in the conducting arm 19.

A link 33 is pivotally connected with the operating member 27 at 34 and with the actuator 31 at 35. With the parts in the normal closed-circuit position as shown in Fig. 2, the pivotal axis at 34 is above a straight line connecting the pivotal axes at 28 and 35, the operating member itself thus cooperating with the link 33 to form a normally locked toggle. A member 36 extending transversely between the frame plates engages a suitable shoulder on the handle member to limit movement thereof in the counter-clockwise direction.

The before-mentioned latch 30 normally engages the actuator 31 and holds it in its normal relationship with the other parts as shown in Fig. 2. The bi-metallic latch 30 may be mounted and held in different ways, but as shown it is provided with an angularly bent portion 30^a which is parallel to and in contact with the angularly bent portion 19^a of the conducting bar 19. It may be held by the same rivet 22 which connects the conducting bar 19 with the operating arm 21. The before-mentioned flexible conductor 18 is electrically connected with the bi-metallic latch 30 near the upper latching end thereof. This connection may be effected by brazing.

With the circuit breaker in closed-circuit po-

sition as shown in Fig. 2 it will be apparent that electrical connection is established from the stationary contact 10 to the movable contact 20, thence through the conducting bar 19 and the rivet 22 to the bi-metallic latch 30, and thence through the flexible conductor 18 to the stationary conductor 14.

As already stated, the contact member is biased in the circuit-opening direction by means of the spring 25, and the operating member is biased in the clockwise or circuit-opening direction by means of the spring 29. However, actual movement in the circuit-opening direction is normally prevented by reason of the described toggle relationship between the operating member itself and the link 33, it being understood that the latch 30 normally holds the actuator 31 from relative movement in the clockwise direction.

Normally the operating member 27 may be moved to move the contact member and thus open or close the circuit. During such normal movements the latch 30 remains engaged with the actuator 31.

If the handle or operating member 27 be held in its closed-circuit position as shown in Figs. 2 and 3 and if an abnormal current condition such as an overload is attained, the bimetallic latch 30 is automatically deflected rearward as indicated in Fig. 3 so as to disengage and release the actuator 31.

When the actuator is no longer held by the latch 30, the entire contact member is moved by the spring 25 to its open-circuit position as shown in Fig. 3, the actuator 31 and the link 33 assuming the relative positions shown in that figure. If the operating member be released after the parts have moved to the relative positions shown in Fig. 3, the spring 29 moves the operating member to the position shown in Fig. 4, this in turn moving the link 33 and the actuator 31 to the positions shown in that figure. The actuator is thus restored to engaged or engageable relationship with the bi-metallic latch 30.

The operation has been described as it occurs when the handle is first held and then released. Ordinarily, however, the operating member is not held and it starts to move to its open-circuit position as soon as the actuator has moved far enough in the clockwise direction to break the locking relationship between the operating member and the link 33. All of the parts thus move practically instantaneously to the position shown in Fig. 4, the actuator being immediately restored to engaging relationship with the latch. As soon as the latch has cooled sufficiently the operating member can be moved to again close the circuit.

In order to adjust the bi-metallic latch 30 for purposes of calibration it may be desirable to provide an adjusting screw 37 extending through a hole in the said latch and into a threaded hole in an extension 21^a of the operating arm. It will be apparent that by adjusting the screw 37 the latch 30 may be moved within certain narrow limits so as to be adapted to release the actuator upon the attainment of predetermined overload condition.

In accordance with the present invention I not only provide a bi-metallic element such as 30 but also a second bi-metallic element such as 38 closely adjacent the element 30 and in fixed relationship therewith. As shown, the element 38 is between the element 30 and the conducting member 19, the two elements being separated by a sheet 39 of suitable insulating ma-

terial such as mica. As shown the bi-metallic element 38 has an angularly bent portion 38^a between the portions 30^a and 19^a, all of the said portions being held by the said rivet 22. The bi-metallic element 38 and the mica sheet 39 have relatively large holes therein to provide ample clearance for the adjusting screw 37.

Let it be assumed that the circuit breaker is subjected to a moderate overload which the bi-metallic latch 30 would carry indefinitely without sufficient deflection to cause release of the actuator 31. However, the latch 30 is heated to some extent and the heat thereof is slowly transmitted to the bi-metallic element 38. The element 38 is of such character that it has a greater amount of deflection for a given temperature, and therefore the element 38 upon finally becoming heated deflects rearward and acts mechanically on the latch 30 to increase the deflection thereof. The latch 30 upon being thus additionally deflected releases the actuator 31 and the circuit is opened in the manner already described.

What I claim is:

1. In combination in an automatic circuit breaker, a contact biased for movement to break the circuit, releasable mechanism normally holding the contact in closed-circuit position and including a bi-metallic element held at one end and capable of deflection when heated to cause the other end to relatively move and thereby effect the release of the mechanism, means for connecting the bi-metallic element in the circuit to cause the heating thereof as the result of excess

current conditions therein, and a second bi-metallic element positioned immediately adjacent the first element but mounted and arranged so as not to carry current, the said second element being heated and deflected solely by heat transmitted from the first element and the second element when so heated and deflected acting upon the first element to increase the deflection thereof.

2. In an automatic circuit breaker, the combination of a stationary contact, a movable contact member having a contact adapted to engage and disengage the stationary contact, the said contact member being biased for movement toward its open-circuit position and being normally mechanically held against such movement, a thermostatic bi-metallic element supported upon and bodily movable with the contact member and connected in the circuit to be heated upon the attainment of an abnormal current condition therein and thus deflected so as to mechanically release the contact member and permit it to automatically move to open-circuit position, and a second bi-metallic element positioned immediately adjacent the first element and bodily movable therewith but mounted and arranged so as not to carry current, the said second element being heated and deflected solely by heat transmitted from the first element and the second element when so heated and deflected acting upon the first element to increase the deflection thereof.

JOSEPH SACHS.